

Interactive comment on “Small-scale heterogeneity of trace metals including REY in deep-sea sediments and pore waters of the Peru Basin, SE equatorial Pacific” by Sophie A. L. Paul et al.

Anonymous Referee #1

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In the manuscript bg-2019-274 “Small-scale heterogeneity of trace metals including REY in deep-sea sediments and pore waters of the Peru Basin, SE Equatorial Pacific,” Paul and coauthors demonstrate that 1) the depositional environment of a specific coring location matters even within a small geographic range and that 2) iron rich clays and phosphates likely control the REY of the sediments.

The authors use the variability of redox sensitive metals, organic matter, and REY between several distinct depositional environments in the Peru Basin to demonstrate that a given core may not be representative of a bigger area. While definitely true, I feel

C1

the authors over-sell a broad ‘small-scale heterogeneity’ emphasis while underplaying the fact that the sites were deliberately chosen in different depositional environments (including the title). Nuanced, but this data set clearly shows the importance of considering depositional environment when selecting sites and the authors don’t really articulate that point, instead the message comes across as a more dismissive ‘they’re all different anyways.’ In presenting this data set, the authors also use solid and fluid phase measurements to address the sediment phases controlling the REY of the sediments. The authors argue that Fe-rich clay mineral and phosphates are the controlling phases based on Fe/Nd, Fe/Al, Fe/P, and P/Ca correlations. I believe the authors are likely correct on this assumption, but am confused as to the lack of recent citations in support of this conclusion.

Generally, the manuscript is well written and adequately cited, however as alluded to above the manuscript seems weighted towards older (pre 2000) citations despite many of these topics growing rapidly over the last decade. The only aspect that was a bit challenging to follow was the jumps between solid phase and fluid phase, mainly as the approach to this wasn’t consistent (e.g. 3.2 and 3.3 split up solid and fluid phases, then 3.4 was solid and fluid) and there were a couple of key details missing from the methods section. A few more specific comments are included below, but overall I feel the authors present a great data set that is relevant and appropriate for publication in Biogeoscience with minor revisions.

Specific comments: P1

31- “only a small part” – has this been quantified? i.e. more impactful if you can at least assign an order of magnitude to it (0.1%? 10%?)

35-36 the number of pore water studies in the last decade has drastically increased but citation list heavily weighted towards earlier ones (e.g. Deng et al 2017 Scientific Reports; Kim et al 2012 Chemical Geology; Schacht et al. 2010 Journal of Geochemical Exploration; Abbott et al 2019 Frontiers in Marine Science)

C2

P3

20-21 again seems like a gap in including recent literature other than the author's own 2019 paper

30 “.. their detrital origin.” reference?

In terms of REE patterns/Ce anomalies: Kang et al. 2014 Journal of Asian Earth Sciences; Kon et al. 2014, Resource Geology

P4

section 2.1 unclear from the next the number of gravity cores taken and their depositional environments (with the exception of the description of the volcanic crater)

25-32 Were the cores sampled in ambient air? How long did the split cores sit before analyses? How are concerns about oxidising pore fluid before centrifugation addressed if sampled in ambient air?

30 Filter size is important – many of the other work compared to is 0.45 micron – not necessarily a problem, just needs to be explicitly recognised

P5

1 Incomplete digestions not mentioned again- need to be discussed in terms of implications

4 1-2 sentences explaining what the apex Q does would help your reader rather than having to go to the ESI website

P8

section 3.5 this section is far less detailed than the precedent set in the earlier sections, stay consistent. Variability? Trends?

P9

C3

section 4.1 one more sentence here reminding readers of the depth of the sites 4125 and 4216 when discussing modern CCD would be helpful

P10

section 4.2 again seems lack recent references (e.g. Baldermann et al 2015 Nature Geoscience; Dong et al 2009 American Mineralogist; Huggett et al 2017 Clay Minerals)

P11

section 4.4 discussion should frame results in context of similar observations in the literature – e.g. lots of work showing Nd and Fe relationship

28-30- “Even though it is... Fe-rich clay minerals.” this sentence is a bit awkward to read but makes one of the main points, worth reworking into 1-3 clear sentences instead of a complicated one.

34- ‘reported for nontronites.’ By who? reference?

P12

11, 27-28 This jumps from the last thought- where is the pore water getting the REY and how do they compare to the sediments? Needs a few more sentences walking the reader through the logic.

P13

sections 4.5-4.6 hard to track dissolved versus solid- separate clearly or consistently label

11 “They display... in oxic waters” is this a general statement or also observed at these stations

28 is the mineralogy of the grey bands known?

P14

C4

7-10 This is a very fair description of the spatial heterogeneity in terms of the different depositional environments

Figures/Tables

Fig 1) the red text is hard to read

Table 1) why is 84GC3 different significant figures for water depth then the rest of the sites?

Figure 2) Can the color bar be larger- very hard to read the text in the key

Figure 9) color coding on this figure is great- makes it really easy to follow what is going on!

Figure 11) is this the same key as figure 12?

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